

# PATENT ABSTRACTS OF JAPAN

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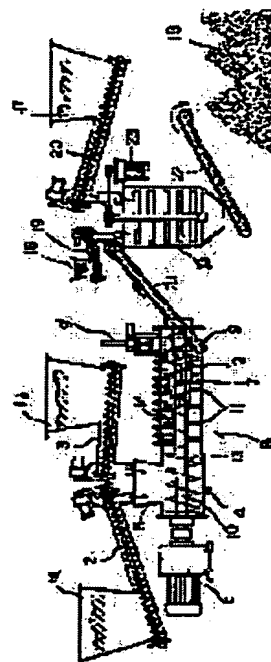
(72)Inventor : INOUE SATOSHI

## (54) PRODUCTION OF COMPOST AND APPARATUS FOR PRESSURIZING AND KNEADING TREATMENT USED THEREFOR

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide both a method for producing a compost in which noxious microorganisms are killed and an apparatus for pressurizing and kneading treatment used therefor.

**SOLUTION:** A compost raw material charged into a pressurizing and kneading treatment tank is pressurized and kneaded with a forced feeding screw for forming mutually opposite internal and external two-layer flows in the forward direction and retreating directions. Thereby, tissue surfaces of microorganisms are broken in a process for circulating a part of the raw material heated up by the pressurizing and kneading in the forward direction in the treatment tank while pressurizing and kneading the raw material in the retreating direction and the resultant microorganisms in the raw material are made to stay at  $\geq 70^{\circ}\text{C}$  temperature for  $\geq 1$  min and killed. A fermenting microorganism is added to the resultant raw material in which the microorganisms are subjected to killing treatment and fermented while pulverizing the raw material, bringing the pulverized raw material into contact with air and cooling the raw material. For that purpose, the forced feeding screw has a structure in which forward screw blades 11 and a retreating screw blade 12 are fixed to a common rotating shaft so as to form internal and external double coaxial blades.



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CLAIMS

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[Claim(s)]

[Claim 1] By pressurizing and kneading with the feeding screw which forms the flow of the Sotoji layer while the advance direction by the side of the discharge gate of a processing tub and the retreat direction from a discharge gate side conflict the compost raw material thrown into pressurization / kneading processing tub of a compost manufacturing installation The inside of a processing tub is circulated pressurizing and kneading some raw materials by which the temperature up was carried out by the pressurization and kneading of the advance direction in the retreat direction. By this Make this raw material pile up 1 minute or more under the temperature of 70 degrees C or more in a processing tub, and the microorganism in a raw material is made to \*\*\*\* at the same time it damages the front face of the microorganism in a raw material. The manufacture approach of the compost characterized by adding and fermenting some composts containing a fermentation micro organism or a fermentation micro organism after cooling [ or ], opening wide said raw material which carried out \*\*\*\* processing from a pressurization condition, making air contact by grinding, and cooling [claim 2] In pressurization / kneading equipment of the compost raw material which arranged the feeding screw for pressurizing and kneading an injection raw material in the shaft orientations of the processing tub which has the injection section of a compost raw material in 1 side, and established the discharge gate in the side else The advance screw wing which a feeding screw feeds while pressurizing and kneading a raw material at an exhaust port side, Pressurization / kneading equipment characterized by having the structure which fixed to the common revolving shaft the retreat screw wing fed while pressurizing and kneading from an exhaust port at an injection hopper side as formed this heart wing of an inside-and-outside duplex [claim 3] Pressurization / kneading equipment of the compost raw material according to claim 2 further characterized by preparing the pressurization acceleration section to which turned the raw material send cross section of the 1st screw wing and the 2nd screw wing in each direction of a raw material send, and some or all in a processing tub was made to reduce it gradually

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to pressurization / kneading processor of the raw material used for the method of processing the raw material which consists of mixture of organic substance content trash, such as zootechnics excrement coconut urine processing sludge and domestic-wasted-water sludge, or the these and the cellulose content organic substance, and manufacturing a compost, and this approach.

[0002]

[Background of the Invention] In recent years, the public nuisance by domestic animal feces discharged from a dairy farmer, such as cow dung and chicken droppings, is expanded, and the E. coli bacillus especially represented by O-157 serves as a social problem. Moreover, from the place which provides most feed of livestock with import, the seed of the weeds currently mixed in import feed passes through the inside of the body of livestock, it buds by Hataji, and these alien weeds are troubling the farmhouse.

[0003] Furthermore, since incineration of city dust or a sludge sludge became difficult on problems, such as dioxin, recently, these composting is advanced quickly, but also after microbial population, such as a virus, is parasitic on these raw materials many Escherichia coli and recently and composting at them, the pathogenic microorganism poses a problem -- a salmonella is detected.

[Problem(s) to be Solved by the Invention]

[0004] Originally, although it was the ideal which is solved by annihilating a harmful microorganism with the fermentation heat when composting a raw material, since these problems needed making a raw material pile up 1 minute or more under the temperature of 70 degrees C or more to annihilate the above-mentioned microbial population, it was difficult problems to realize this by the present composting approach actually. For example, by pressurizing and kneading a compost raw material and carrying out a temperature up with the heat of compression and frictional heat as indicated by JP,5-105564,A Although thermophilic bacteria are activated, the compost manufacturing installation of the so-called screening method which annihilates low and mesophile is already developed by this invention person and the commercial scene is supplied Pressurization / kneading equipment of the raw material currently used for this equipment The flow of the raw material in a processing tub is an one direction, it is for [ at the time of carrying out a temperature up to 70 degrees C or more, since it is the structure which a pressure concentrates near the outlet gate arriving at the outlet gate ] several seconds, and since it is immediately opened wide from an outlet and temperature falls rapidly, a microorganism does not result in \*\*\*\*.

[0005] That is, although it is required to have reached at least the predetermined elevated temperature from near the pars intermedia of a processing tub in order to make raw material temperature maintain 1 minute or more above 70 degrees C by the pressurization of the raw material in a processing tub and kneading, since an elevated temperature predetermined [ at last ] with the conventional above-mentioned pressurization kneading method in near the outlet gate was reached, 1-minute or more predetermined continuation of the temperature of 70 degrees C or more was not able to be carried out. Moreover, if a temperature up tends to be carried out to a predetermined elevated temperature from near pars intermedia and the outlet gate is extracted by the conventional method, near the outlet gate will become high pressure further, and equipment will become

exaggerated power.

[0006] Thus, since the compost manufacturing installation which uses conventional pressurization kneading equipment cannot maintain an elevated-temperature condition required for extinction of microbial population, it cannot produce the compost which annihilated harmful microbial population, such as O-157, as a matter of fact.

[0007] Therefore, the 1st purpose of this invention annihilates the harmful microbial population in a raw material efficiently, and is to offer the manufacture approach of the compost fully fermented as an organic fertilizer moreover.

[0008] The 2nd purpose of this invention is to offer pressurization / kneading equipment which can annihilate the microbial population in a raw material efficiently, in order to enforce the above-mentioned approach.

[0009]

[Means for Solving the Problem] In order to attain the 1st purpose of the above, the compost manufacture approach of this invention By pressurizing and kneading with the feeding screw which forms the flow of the Sotoji layer while the advance direction by the side of the discharge gate of a processing tub and the retreat direction from a discharge gate side conflict the compost raw material thrown into pressurization / kneading processing tub of a compost manufacturing installation The inside of a processing tub is circulated pressurizing and kneading some raw materials by which the temperature up was carried out by the pressurization and kneading of the advance direction in the retreat direction. By this Make this raw material pile up 1 minute or more under the temperature of 70 degrees C or more in a processing tub, and the microorganism in a raw material is made to \*\*\*\* at the same time it damages the front face of the microorganism in a raw material. After cooling [ or ], opening wide said raw material which carried out \*\*\*\* processing from a pressurization condition, making air contact by grinding, and cooling, it is characterized by adding and fermenting some composts containing a fermentation micro organism or a fermentation micro organism.

[0010] In order to attain the 2nd purpose of the above, pressurization / kneading equipment of the compost raw material by this invention In pressurization / kneading equipment of the compost raw material which arranged the feeding screw for pressurizing and kneading an injection raw material in the shaft orientations of the processing tub which has the injection section of a compost raw material in 1 side, and established the discharge gate in the side else The advance screw wing which a feeding screw feeds while pressurizing and kneading a raw material at an exhaust port side, It is characterized by having the structure which fixed to the common revolving shaft the retreat screw wing fed while pressurizing and kneading from an exhaust port at an injection hopper side as formed this heart wing of an inside-and-outside duplex.

[0011] The pressurization acceleration section to which turned the raw material send cross section of the 1st screw wing and the 2nd screw wing in each direction of a raw material send, and some or all in a processing tub was made to reduce it gradually by request may be prepared.

[0012]

[Embodiment of the Invention] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 is what shows the whole compost manufacturing installation configuration by this invention. Organic substance content trash 1a, such as zootechnics excrement, such as cow dung and chicken droppings, nightsoil treatment sludge, and sewage-from-homes sludge, Cellulose content organic substance 1b, such as grass used as zootechnics litter, straw, chaff, and a wood chip, as a compost raw material Through each constant feeding feeder 2 and the adjustable supply feeder 3, it is sent to the injection hopper 5 of pressurization / kneading processing tub 4, the above-mentioned trash 1a and cellulose content organic substance 1b are mixed, and these raw materials are adjusted to 45 - 75 % of the weight of moisture. In this case, the cellulose content organic substance is used as moisture adjustment material of a raw material.

[0013] The raw material thrown into pressurization / kneading processing tub 4 annihilates said microbial population in a raw material by making it pile up 1 minute or more under the temperature of 70 degrees C or more in pressurization / kneading processing tub 4 with the heat of compression and frictional heat while the front face of microorganisms, such as Escherichia coli in a raw material, bacteria, and a virus, receives damage by being pressurized and kneaded with the feeding screw 7 by which a rotation drive is carried out by the prime mover 6.

[0014] That is, after doing damage to the organization chart side of the microorganism in a raw material, this invention makes 1 minutes or more of microbial population which has received this damage exist under the temperature of 70 degrees C or more, when a damage organization does predetermined time stay under [ of an elevated temperature ] the above, heightens a bactericidal effect and annihilates a microorganism. For this reason, in this invention, as shown below, special pressurization / kneading processing is made by new pressurization / kneading equipment.

[0015] Said feeding screw 7 by which a rotation drive is carried out by the prime movers 6, such as a motor, is installed in the shaft orientations in pressurization / kneading processing tub 4 which pressurization / kneading equipment 8 used for this invention has the raw material injection hopper 5 in 1 side as shown in drawing 1 R> 1 and drawing 2 , and has an exhaust port 9 in the side else. In addition, an exhaust port 9 is opened and closed by gate 9'.

[0016] As this feeding screw 7 forms this heart screw of an inside Sotoji pile in the revolving shaft 10 with common advance screw wing 11 sent out while pressurizing and kneading a raw material at an exhaust port 9 side and retreat screw wing 12 put back while pressurizing and kneading from an exhaust port 9 side at the injection hopper 5 side, it is being fixed to it.

[0017] Pressurization / kneading equipment 8 of the example of drawing has designed the sense so that the piece of a wing fixed to the outside of this retreat screw wing 12 through frame 11' may serve as the advance screw wing 11, while designing the sense so that the spiral screw attached in the axis of a revolving shaft 10 may serve as the retreat screw wing 12. In addition, as shown in drawing, the same raw material send screw 13 as usual may be formed in the revolving-shaft section of the lower part of a hopper 5. Furthermore, in order to cut a raw material and to control \*\*\*\*\* of a revolving shaft 10 and a raw material, you may protrude an anchor tooth 14 towards the inside of the processing tub 4.

[0018] In the example of drawing, the inside screw wing 12 is formed with a spiral screw, the piece of a wing of the outside screw wing 11 is combined with frame 11' fixed between the pitches of the inside screw wing 12, and this heart screw of an inside Sotoji pile is formed. However, as long as the feeding screw 7 of pressurization / kneading equipment 8 of this invention has the function in which the screw of an inside Sotoji pile is really combined with a revolving shaft 10 in the said alignment, and the inside screw wing 12 and the outside screw wing 11 pressurize and knead the raw material of each other in hard flow, what kind of other structures are sufficient as it. For example, the inside screw wing 12 may be used as an advance screw wing contrary to the example of drawing, and the outside screw wing 11 may be designed as a retreating blade.

[0019] Moreover, towards back to the front, although homogeneity is sufficient as the path of the advance screw wing 11 of the feeding screw 7, and the retreat screw wing 12, i.e., the feeding cross section, it is formed in the shape of a taper like [ it is desirable and ] the example of drawing 1 and drawing 2 , so that the feeding cross section may contract gradually towards each raw material feed direction. Thus, a configuration advances pressurization of the raw material of a travelling direction and the retreat direction at an increasing tempo. therefore, high temperature is made to carry out the temperature up of the raw material for a short time, and more long in an elevated temperature -- time amount maintenance can be carried out. Like chicken droppings, the thing of this structure is advantageous, when there is comparatively much moisture of a raw material.

[0020] Moreover, in the case of a viscous low raw material, it is good in a \*\* pitch like cow dung in the pitch of the advance screw wing 11 and the go-astern screw wing 12, but in the case of a viscous high raw material, it is desirable like chicken droppings to extend the pitch of a screw gradually.

[0021] Explanation of pressurization / kneading process of the raw material by pressurization / kneading equipment of the example of drawing sends out the raw material introduced from the injection hopper 5 of the processing tub 4 to the feeding screw 7 on the send screw 13. The raw material supplied to the feeding screw 7 is pressurized and kneaded by the outside advance screw wing 11, and it is sent out to an exhaust port 9 side, shearing with an anchor tooth 14, and a temperature up is carried out with the heat of compression and frictional heat in the process.

[0022] Since the feeding screw 7 is arranged so that it may become the double layer of this heart as mentioned above about the outside advance screw wing 11 and the outside retreat screw wing 12, some raw materials by which the temperature up was carried out by the advance screw wing 11 are involved in the inside retreat screw wing 12 in the exhaust port 9 neighborhood, and temperature

risers further in the process pressurized and kneaded to hard flow. Since friction of passing each other of the raw material of the advance direction and the raw material of the retreat direction is especially added at pressurization / kneading process of hard flow By being further pressurized and kneaded, while the temperature up of a raw material is promoted, and the raw material by which the temperature up was carried out circulates through the inside-and-outside screw of the feeding screw 7 A raw material amounts to 70 degrees C or more near the middle of the processing tub 4, and since it is further pressurized and kneaded to discharge gate 9' by the advance screw wing 11 in the condition, finally the temperature up of it can be carried out to 90 degrees C by the posterior part of the feeding screw 7, i.e., the example of drawing. In addition, the raw material feed per revolution of the advance direction and the retreat direction has about 6 to 4 desirable rate.

[0023] Thus, while a temperature up is further carried out beyond this temperature, this invention piles up in the processing tub 4, until a raw material amounts to 70 degrees C or more in the mid-position of the processing tub 4 and it is sent to an exhaust port 9 from this location. Therefore, when a raw material is preferably maintained by the basis with a temperature of 70 degrees C or more 3 minutes or more at least 1 minute or more, E. coli bacilli, such as O-157, are begun and microbial population, such as a bacillus and a virus, becomes extinct.

[0024] By the above-mentioned elevated-temperature maintenance processing, since the elevated-temperature zymogen required for composting has also become extinct, the way things stand, the raw material emitted from pressurization / kneading equipment 8 does not ferment. For this reason, it is necessary to add the new microorganism aiming at fermentation. however, \*\* from the need of moreover maintaining at the moisture suitable for fermentation the processing raw material which comes out from the exhaust port 9 of \*\* et al. and the processing tub 4 at an elevated temperature -- since it is massive, even if it newly puts in a bacillus (microorganism), it does not increase.

[0025] This invention pulverizes the raw material further discharged from the processing tub 4 with a grinder 15, in order to solve the above-mentioned problem, after being the process which carries out the fermentation temperature control by cooling while making air contact enough by this or considering a temperature control as grinding, the microorganism for fermentation is added from a tank 16, or some composts which contain the fermentation micro organism from the tank 17 are added, and it is made to ferment.

[0026] By putting on the bottom of predetermined time and a deposition fermentation condition, the fermentation only by the superior microorganism progresses and the raw material which newly added the fermentation micro organism in this way serves as a compost 18.

[0027]

[Effect] Since it is maintained by this elevated temperature until the microbial population which the raw material carried out [ microbial population ] the temperature up of this invention to 70 degrees C or more near the mid-position of a processing tub, and made the organization chart side destroy is emitted from the exhaust port of a processing tub, E. coli bacilli, such as O-157, bacteria, a virus, etc. can become extinct effectively, and can manufacture a safe compost. Moreover, it can \*\*\*\* certainly by doing damage to the surface cell membrane of a seed or a bacillus by intense friction of a raw material.

[0028] After annihilating the microbial population of a raw material, since this invention is fermented only by the superior microorganism for agriculture, it can produce a good compost by low cost. Although the attempt used adding for organic materials and making them increase by making the small quantity of these microorganisms into \*\*\*\* from a cost side was made when the compost of the good-quality microorganism was conventionally added and carried out to a raw material, there was a problem of the influence of the settlement implantation bacillus of a raw material having been strong, and being hard to increase the bacillus put in newly. Since this invention has annihilated the bacillus of a raw material, and the microorganism, culture growth of an addition effective bacillus becomes easy, and it also solves these problems.

[0029] Although the mixed acid of organic acids, such as a valeric acid which is the main causative agent of the offensive odor at the time of compost manufacture, butanoic acid, and a caproic acid, has a carboxyl group (COOH), this carboxyl group separates in continuation of high temperature 55 degrees C or more, and since it stops vaporizing in the air, an offensive odor decreases sharply.

[0030] It can decrease power consumption 40% as compared with the case where pressurization /

kneading screw of an one direction is used while it can offer an efficient elevated-temperature maintenance device with the equipment of small and low cost, since the feeding screw which allotted this heart screw of the Sotoji pile while pressurizing and kneading the raw material is being used for pressurization / kneading equipment used for this invention in the direction which faces.

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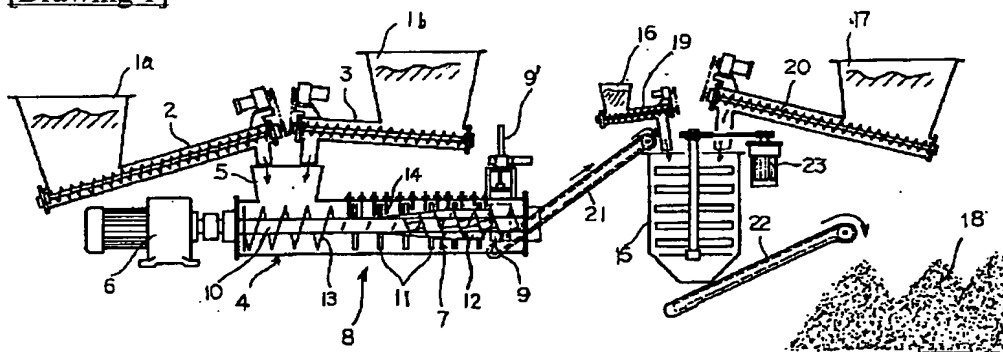
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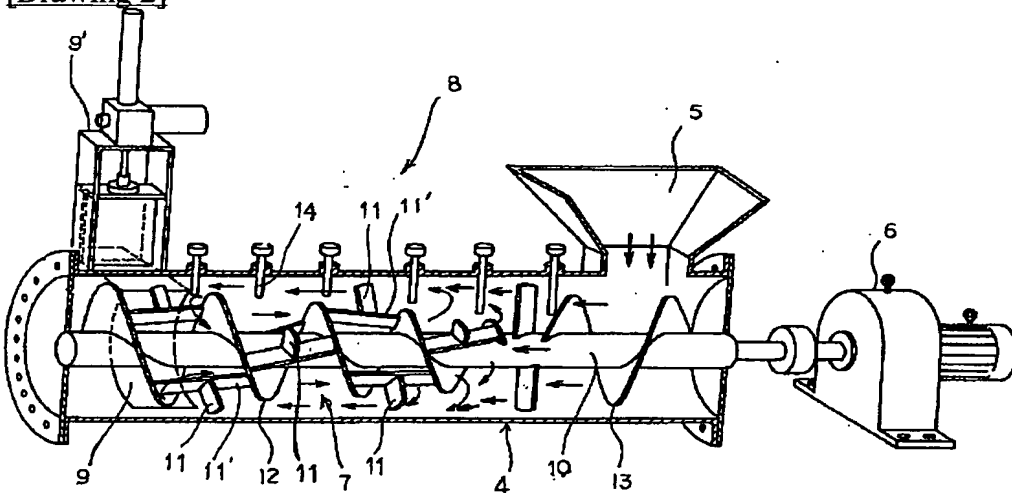
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## DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

## PRODUCTION OF COMPOST AND APPARATUS FOR PRESSURIZING AND KNEADING TREATMENT USED THEREFOR

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**Inventor:** INOUE SATOSHI

**Applicant:** INOUE SATOSHI

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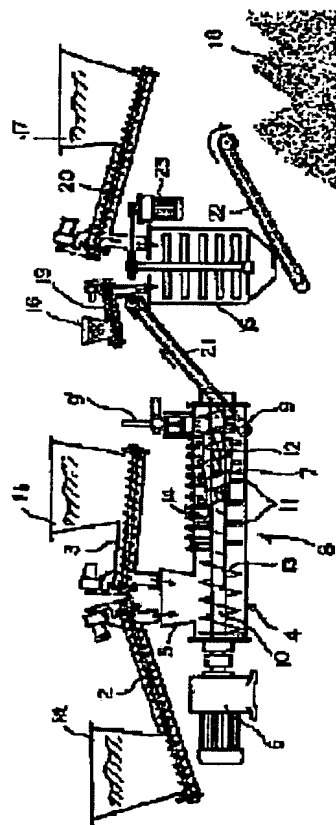
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### Abstract of JP2000169274

**PROBLEM TO BE SOLVED:** To provide both a method for producing a compost in which noxious microorganisms are killed and an apparatus for pressurizing and kneading treatment used therefor. **SOLUTION:** A compost raw material charged into a pressurizing and kneading treatment tank is pressurized and kneaded with a forced feeding screw for forming mutually opposite internal and external two-layer flows in the forward direction and retreating directions. Thereby, tissue surfaces of microorganisms are broken in a process for circulating a part of the raw material heated up by the pressurizing and kneading in the forward direction in the treatment tank while pressurizing and kneading the raw material in the retreating direction and the resultant microorganisms in the raw material are made to stay at  $\geq 70$  deg.C temperature for  $\geq 1$  min and killed. A fermenting microorganism is added to the resultant raw material in which the microorganisms are subjected to killing treatment and fermented while pulverizing the raw material, bringing the pulverized raw material into contact with air and cooling the raw material. For that purpose, the forced feeding screw has a structure in which forward screw blades 11 and a retreating screw blade 12 are fixed to a common rotating shaft so as to form internal and external double coaxial blades.



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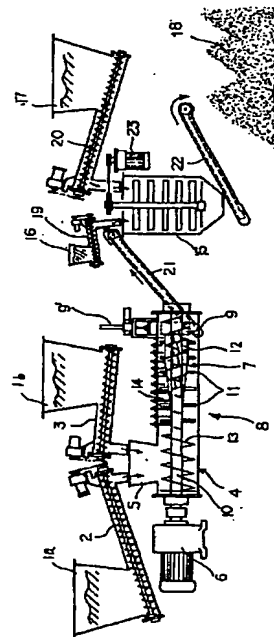
(54) 【発明の名称】 堆肥の製造方法及びこの方法に使用する加圧・混練処

理装置

(57) 【要約】

【課題】 有害微生物を死滅させた堆肥の製造方法及びこれに使用する加圧・混練処理を提供する

【解決手段】 加圧・混練処理槽に投入した堆肥原料を前進方向と後退方向の相反する内外二層の流れを形成する圧送スクリューで加圧・混練する。これにより、前進方向の加圧・混練で昇温された原料の一部を後退方向へ加圧・混練しながら処理槽内を循環させる過程で、組織表面を破壊させた微生物を70℃以上の温度下に1分以上滞留させて原料中の微生物を殺死させる。殺死処理した原料を粉碎して空気と接触させて冷却しながら発酵微生物を添加して発酵させる。こため、加圧・混練装置の圧送スクリューは、前進スクリュー羽根と後退スクリュー羽根を、内外二重の同芯羽根を形成するようにして共通回転軸に固定した構造になっている。



## 【特許請求の範囲】

【請求項1】 堆肥製造装置の加圧・混練処理槽に投入した堆肥原料を処理槽の排出ゲート側への前進方向と排出ゲート側からの後退方向の相反する内外二層の流れを形成する圧送スクリーで加圧・混練することにより、前進方向の加圧・混練で昇温された原料の一部を後退方向へ加圧・混練しながら処理槽内を循環させ、これにより、原料中の微生物の表面を損傷させると同時にこの原料を処理槽内において70℃以上の温度下に1分以上滞留させて原料中の微生物を殺死させ、殺死処理した前記原料を加圧状態から開放し、粉碎により空気と接触させて冷却しながら、又は冷却した後、発酵微生物又は発酵微生物を含む堆肥の一部を添加して発酵させることを特徴とする堆肥の製造方法

【請求項2】 一側に堆肥原料の投入部を有し、他側に排出ゲートを設けた処理槽の軸方向に、投入原料を加圧・混練するための圧送スクリーを配設した堆肥原料の加圧・混練装置において、圧送スクリーが、原料を排出口側に加圧・混練しながら圧送する前進スクリー羽根と、排出口から投入ホッパ側に加圧・混練しながら圧送する後退スクリー羽根を、内外二重の同芯羽根を形成するようにして共通回転軸に固定した構造を備えていることを特徴とする加圧・混練装置

【請求項3】 処理槽内の一部又は全部に、第1スクリー羽根と第2スクリー羽根の原料送り出し断面積を、それぞれの原料送り出し方向に向けて次第に縮小させた加圧加速部を設けたことをさらに特徴とする請求項2記載の堆肥原料の加圧・混練装置

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は畜産排泄物やし尿処理汚泥、生活排水汚泥等の有機物含有廃棄物またはこれらとセルロース含有有機物の混合物からなる原料を処理して堆肥を製造する方法及びこの方法に使用する原料の加圧・混練処理装置に関する。

## 【0002】

【発明の背景】近年、畜産農家から排出される牛糞、鶏糞などの畜糞による公害が拡大し、特に、O-157に代表される病原性大腸菌が社会問題となっている。また、家畜の飼料のほとんどを輸入で賄っているところから、輸入飼料に混入している雑草の種子が家畜の体内を通過して畑地で発芽し、これらの外来雑草が農家を苦しめている。

【0003】さらに、最近、ダイオキシンなどの問題で都市ゴミや汚泥スラッジの焼却が困難になったことから、これらの堆肥化が急速に進められているが、これらの原料には多くの大腸菌、最近、ウイルスなどの微生物群が寄生しており、堆肥化した後でもサルモネラ菌が検出されるなど、病原性微生物が問題となっている。

【発明が解決しようとする課題】

【0004】本来、これらの問題は、原料を堆肥化するときの発酵熱によって有害微生物を死滅させることによって解決するのが理想であるが、上記の微生物群を死滅させるには原料を70℃以上の温度下に1分以上、滞留させることが必要であるため、現実には現今の堆肥化方法でこれを実現することは困難であった。例えば、特開平5-105564号公報に開示されているように、堆肥原料を加圧・混練して圧縮熱と摩擦熱で昇温させることにより、高温菌を活性化し、低・中温菌を死滅させる、いわゆるスクリーニング方式の堆肥製造装置はすでに本発明者によって開発され、市場に供給されているが、この装置に使用されている原料の加圧・混練装置は、処理槽内の原料の流れが一方向であり、出口ゲート付近に圧力が集中する構造であるため、70℃以上に昇温するのは出口ゲートに達した時点の数秒間であり、直ちに出口から開放されて急激に温度が低下するため、微生物は殺死にいたらない。

【0005】すなわち、処理槽内の原料の加圧・混練によって原料温度を70℃以上で1分以上持続させるには、少なくとも、処理槽の中間部付近から所定の高温に達していることが必要であるが、従来の上記加圧混練方式では、出口ゲート付近でようやく所定の高温に達するに過ぎないため、70℃以上の温度を1分以上所定持続させることができなかった。また、従来の方式で、中間部付近から所定の高温に昇温させようとして出口ゲートを絞ると、出口ゲート付近がさらに高圧となり装置がオーバーパワーとなってしまふ。

【0006】このように、従来の加圧混練装置を使用する堆肥製造装置は、微生物群の死滅に必要な高温状態を維持できないため、O-157などの有害微生物群を死滅させた堆肥を生産することが事実上不可能であった。

【0007】従って、本発明の第1の目的は、原料中の有害微生物群を効率よく死滅させ、しかも、有機肥料として充分に発酵させた堆肥の製造方法を提供することにある。

【0008】本発明の第2の目的は、上記の方法を実施するために、原料中の微生物群を効率よく死滅させることができる加圧・混練装置を提供することにある。

## 【0009】

【課題を解決するための手段】上記第1の目的を達成するために、本発明の堆肥製造方法は、堆肥製造装置の加圧・混練処理槽に投入した堆肥原料を処理槽の排出ゲート側への前進方向と排出ゲート側からの後退方向の相反する内外二層の流れを形成する圧送スクリーで加圧・混練することにより、前進方向の加圧・混練で昇温された原料の一部を後退方向へ加圧・混練しながら処理槽内を循環させ、これにより、原料中の微生物の表面を損傷させると同時にこの原料を処理槽内において70℃以上の温度下に1分以上滞留させて原料中の微生物を殺死させ、殺死処理した前記原料を加圧状態から開放し、粉碎

により空気と接触させて冷却しながら、又は冷却した後、発酵微生物又は発酵微生物を含む堆肥の一部を添加して発酵させることを特徴とする。

【0010】上記第2の目的を達成するために、本発明による堆肥原料の加圧・混練装置は、一側に堆肥原料の投入部を有し、他側に排出ゲートを設けた処理槽の軸方向に、投入原料を加圧・混練するための圧送スクリーを配設した堆肥原料の加圧・混練装置において、圧送スクリーが、原料を排出口側に加圧・混練しながら圧送する前進スクリー羽根と、排出口から投入ホッパ側に加圧・混練しながら圧送する後退スクリー羽根を、内外二重の同芯羽根を形成するようにして共通回転軸に固定した構造を備えていることを特徴とする。

【0011】所望により、処理槽内の一部又は全部に、第1スクリー羽根と第2スクリー羽根の原料送り出し断面積を、それぞれの原料送り出し方向に向けて次第に縮小させた加圧加速部を設けてもよい。

【0012】

【発明の実施の形態】以下、図面を参照して本発明の実施例を説明する。図1は本発明による堆肥製造装置の全体構成を示すもので、牛糞、鶏糞などの畜産排泄物、し尿処理汚泥、生活雑排汚泥などの有機物含有廃棄物1aと、畜産敷料として使用される草、わら、粉穀、木材チップなどのセルロース含有有機物1bが、堆肥原料として、各々の定量供給フィーダ2、可変供給フィーダ3を介して、加圧・混練処理槽4の投入ホッパ5に送られ、上記廃棄物1aとセルロース含有有機物1bを混合して、これら原料を水分45～75重量%に調整する。この場合、セルロース含有有機物は原料の水分調整材として使用される。

【0013】加圧・混練処理槽4に投入された原料は、原動機6によって回転駆動される圧送スクリー7で加圧・混練されることにより、原料中の大腸菌、細菌、ウイルスなどの微生物の表面が損傷を受けるとともに、圧縮熱と摩擦熱により加圧・混練処理槽4内において70℃以上の温度下に1分以上滞留させることにより、原料中の前記微生物群を死滅させる。

【0014】すなわち、本発明は、原料中の微生物の組織表面に損傷を与えた上で、この損傷を受けている微生物群を70℃以上の温度下に1分以上存在させるもので、損傷組織が上記高温の下に所定時間滞在することによって殺菌効果を高め、微生物を死滅させるものである。このために、本発明では以下に示すように、新規な加圧・混練装置により、特殊な加圧・混練処理がなされる。

【0015】本発明に使用される加圧・混練装置8は図1及び図2に示すように一側に原料投入ホッパ5を有し、他側に排出口9を有する加圧・混練処理槽4内の軸方向に、モータ等の原動機6によって回転駆動される前記圧送スクリー7が設置されている。尚、排出口9は

ゲート9'によって開閉されるようになっている。

【0016】この圧送スクリー7は、原料を排出口9側に加圧・混練しながら送り出す前進スクリー羽根11と、排出口9側から投入ホッパ5側に加圧・混練しながら押し戻す後退スクリー羽根12が共通の回転軸10に内外二重の同芯スクリーを形成するようにして固定されている。

【0017】図の実施例の加圧・混練装置8は、回転軸10の軸体に取り付けた螺旋スクリーが後退スクリー羽根12となるように向きを設計するとともに、この後退スクリー羽根12の外側にフレーム11'を介して固定した羽根片が前進スクリー羽根11となるように向きを設計してある。尚、図に示すように、ホッパ5の下方の回転軸部には従来と同様の原料送り出しスクリー13を設けておいてもよい。さらに、原料を切断し、また、回転軸10と原料の共廻りを抑制するために処理槽4内に向けて固定歯14を突設してもよい。

【0018】図の実施例では内側のスクリー羽根12を螺旋スクリーで形成し、内側スクリー羽根12のピッチ間に固定されたフレーム11'に外側スクリー羽根11の羽根片を結合して内外二重の同芯スクリーを形成している。ただし、本発明の加圧・混練装置8の圧送スクリー7は回転軸10に内外二重のスクリーが同心的に一体結合され、内側スクリー羽根12と外側スクリー羽根11が原料を互いに逆方向で加圧・混練する機能を有するものであれば、他のいかなる構造でもよい。例えば、図の実施例とは逆に内側スクリー羽根12を前進スクリー羽根とし、外側スクリー羽根11を後退羽根として設計してもよい。

【0019】また、圧送スクリー7の前進スクリー羽根11と後退スクリー羽根12の径、すなわち、圧送断面積は後方から前方に向けて均一でもよいが、好ましくは図1、図2の実施例のように、各々の原料送り方向に向けて次第に圧送断面積が縮小するようにテーパ状に形成する。このように構成すると進行方向及び後退方向の原料の加圧が加速度的に進む。従って、原料を短時間に高い温度に昇温させ、高温をより長い時間維持させることができる。この構造のものは鶏糞のように原料の水分が比較的多い場合に有利である。

【0020】また、前進スクリー羽根11、後進スクリー羽根12のピッチは、牛糞のように粘性の低い原料の場合は等ピッチでよいが、鶏糞のように粘性の高い原料の場合はスクリーのピッチを次第に広げることが望ましい。

【0021】図の実施例の加圧・混練装置による原料の加圧・混練工程を説明すると、処理槽4の投入ホッパ5から導入された原料は、送り出しスクリー13によって、圧送スクリー7に送り出される。圧送スクリー7に供給された原料は、外側の前進スクリー羽根11によって加圧・混練され、また、固定歯14によって剪

断されながら排出口9側に送り出され、その過程で圧縮熱、摩擦熱によって昇温される。

【0022】圧送スクリュウ7は、前記のように外側の前進スクリュウ羽根11と後退スクリュウ羽根12を同芯の二重層となるように配置してあるので、前進スクリュウ羽根11によって昇温された原料の一部は排出口9付近で内側の後退スクリュウ羽根12に巻き込まれ、逆方向へ加圧・混練される過程で温度がさらに上昇する。特に、逆方向の加圧・混練工程では前進方向の原料と後退方向の原料のすれ違いの摩擦が付加されるので、原料の昇温が促進されるとともに、昇温された原料が圧送スクリュウ7の内外スクリュウを循環しながらさらに加圧・混練されることにより、原料は圧送スクリュウ7の後部、すなわち、図の例では処理槽4の中間付近で70℃以上達し、その状態でさらに前進スクリュウ羽根11によって排出ゲート9まで加圧・混練されるため、最終的には90℃に昇温させることができる。尚、前進方向と後退方向の原料送り量は6対4程度の割合が好ましい。

【0023】このように、本発明は、処理槽4の中間位置で原料が70℃以上に達し、この位置から排出口9に送られるまでの間、この温度以上にさらに昇温されながら処理槽4内に滞留する。従って、原料は70℃以上の温度のもとに少なくとも1分以上、好ましくは3分以上維持されることにより、O-157などの病原性大腸菌をはじめ、菌、ウイルスなどの微生物群が死滅する。

【0024】加圧・混練装置8から放出された原料は上記の高温維持処理により、堆肥化に必要な高温発酵菌も死滅しているので、このままでは発酵しない。このため、発酵を目的とした新たな微生物を添加する必要がある。しかし乍ら、処理槽4の排出口9から出てくる処理原料は、高温で、しかも、発酵に適した水分に保つ必要から固塊状になっているので新たに菌（微生物）を入れても増殖しない。

【0025】上記の問題を解決するために、本発明はさらに、処理槽4から排出される原料を、粉砕機15で微粉砕し、これにより、空気と充分接触させながら冷却による発酵温度調整をする過程で、あるいは、粉砕と温度調整をした後に、タンク16から発酵のための微生物を添加するか、もしくは、タンク17から発酵微生物を含んでいる堆肥の一部を添加して発酵させる。

【0026】かくして、新たに発酵微生物を添加した原料は所定時間、堆積発酵条件下に置くことにより、優良微生物のみによる発酵が進み堆肥18となる。

【0027】

【効果】本発明は原料が処理槽の中間位置付近で70℃以上に昇温し、組織表面を破壊させた微生物群が処理槽の排出口から放出されるまでの間、この高温に維持されるので、O-157などの病原性大腸菌、細菌、ウイルス等が効果的に死滅し、安全な堆肥を製造することがで

きる。また、原料の激しい摩擦により、種子や菌の表面細胞膜に損傷を与えることによって確実に殺死することができる。

【0028】本発明は原料の微生物群を死滅させた後、優良な農業用微生物だけで発酵させるので良質な堆肥を低コストで生産することができる。従来、原料に良質微生物を添加して堆肥する場合、コスト面からこれらの微生物の少量を基菌として有機資材に添加し、増殖させて使用する試みがなされているが、原料の定住着床菌の勢力が強く、新しく入れた菌が増殖しにくいという問題があった。本発明は原料の菌、微生物を死滅させてあるので、添加有効菌の培養増殖が容易となり、これらの問題も解消する。

【0029】堆肥製造時の悪臭の主要原因物質である吉草酸、酪酸、カプロン酸等の有機酸の混酸は、カルボキシル基(COOH)を持っているが、55℃以上の高温の持続でこのカルボキシル基が外れ、空中に揮散しなくなるので悪臭が大幅に減少する。

【0030】本発明に使用される加圧・混練装置は、相対する方向に原料を加圧・混練する内外二重の同芯スクリュウを配した圧送スクリュウを使用しているので、効率のよい高温維持機構を小型、低コストの装置で提供することができるとともに、一方向の加圧・混練スクリュウを使用する場合に比較して電力消費を40%減少させることができる。

【図面の簡単な説明】

【図1】本発明の方法を実施する堆肥製造装置の全体構成図

【図2】本発明の方法に使用される原料加圧・混練装置の拡大断面図

【符号の説明】

1 a…有機物含有廃棄物

1 b…セルロース含有有機物

2、3…フィーダ

4…加圧・混練処理槽

5…投入ホッパ

6…原動機

7…圧送スクリュウ

8…加圧・混練装置

9…排出口

9'…排出ゲート

10…回転軸

11…前進スクリュウ羽根

11'…フレーム

12…後退スクリュウ羽根

13…送り出しスクリュウ

14…固定歯

15…粉砕機

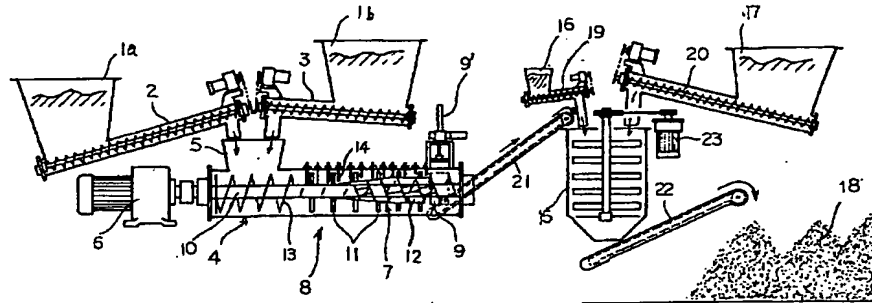
16、17…タンク

18…堆肥

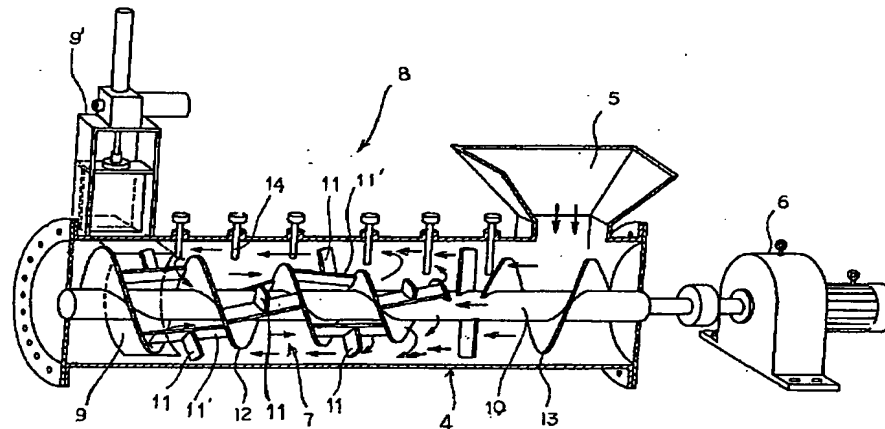
7  
19、20、21、22…フィーダ

23…モータ

【図1】



【図2】



フロントページの続き

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